UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

FOREST INSECT SURVEYS
AERIAL DETECTION
SEASON OF 1949

by

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Oregon State Board of Forestry

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Bureau of Entomology and Plant Quarantine

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old home in
St Helens

2/50

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FOREST INSECT SURVEYS

AERIAL DETECTION PHASE

SEASON OF 1949

INTRODUCTION

The year of 1949 marks the first time that all of the forty-nine million acres of coniferous timber type in Oregon and Washington, exclusive of Spokane, Pend Oreille, and Stevens Counties in northeastern Washington, which are under the jurisdiction of Region 1 of the Forest Service and the Forest Insect Station at Coeur D'Alene, Idaho, have been covered by a forest insect survey.

This survey was conducted in two phases, namely, aerial and ground. The aerial phase of the survey, with which this report deals, was carried out as a cooperative project between the Oregon State Board of Forestry, the U. S. Forest Service, and the Bureau of Entomology and Plant Quarantine.

The field work was carried on by two crews, the personnel of which were as follows: Crew No. 1 - pilot, James Brigham, and observer, Alvin Lindsten, of the Oregon State Board of Forestry, also observer Kenneth Wright of the Bureau of Entomology; this crew covered timber stands in Oregon west of the Cascade Summit amounting to some fifteen million acres. Crew No. 2 - pilot, J. F. Wear, and observer, W. J. Buckhorn, of the Bureau of Entomology and Plant Quarantine; they were assisted during four days by R. C. Heller of the Washington office of the Bureau of Entomology; this crew covered the timber stands in Oregon east of the Cascade Summit and the stands in Washington, which amounted to some thirty-four million acres.

Aircraft for the survey, except for the coastal region of Washington, was contracted for by both the State and Forest Service. The State furnished the ships for Crew No. 1. This crew used a Stinson station wagon for two days at the start of the survey and a Cessna "170" the remainder of the time. The Forest Service provided Crew No. 2 with a two-place Luscombe "Observer". However, a larger plane was needed when Heller joined the crew and the Service provided a Cessna "170" for that period. The coastal region of Washington was covered in a Cessna "195" recently acquired by this Bureau. The Cessnas proved to be excellent ships for this type of work. The operational phase of the survey is summarized in Table No. 1.

Survey methods employed by the two crews closely followed the methods developed by Buckhorn and Wear on the aerial surveys in eastern Oregon during 1947 and 1948. All major forest types were intensively covered either by "contouring" or "gridironing". All infestations, both bark beetle and defoliator, were sketch-mapped in place according to degree of intensity. The course of the plane was plotted on the map simultaneous with the progress of flight in order to keep oriented with the ground and to assure complete coverage of all areas.

Crew No. 1 began the survey of western Oregon on July 6. Considerable cloudiness and rain prevailed but by shifting operations from one portion of the area to another they were able to circumvent the weather and this portion of the region was completed by August 1.

Crew No. 2 began operations in the Blue Mountains region of Oregon on July 12. Eastern portions of Oregon and Washington were completed by August 6, but due to clouds, rain and smoke, western Washington was not completed until October 19.

Although the survey period in western Washington was more prolonged than desirable for spotting defoliations, it is felt that no significant infestations were missed.

After the aerial reconnaissance was completed, or while waiting out periods of bad weather, ground examinations were made on the more critical centers of infestation spotted from the air. Wright and Lindsten carried on the ground checking in western Oregon. Buckhorn and Wear checked most of the areas spotted in eastern Oregon. Mr. J. M. Whiteside of the Bureau visited a number of infestation centers in eastern Washington, and Mr. W. K. Coulter, also of the Bureau, ground-checked most of the centers spotted in western Washington.

DEFOLIATORS

Spruce Budworm (~~Archips~~) Choristoneura (fumiferana)).

The spruce budworm continued aggressive during 1949. Known centers expanded considerably and many new areas were detected. In certain areas the accumulative effects of repeated heavy defoliations have resulted in almost complete destruction of the stand.

$$\begin{array}{r} 465,480 \\ \underline{325,664} \\ 791,144 \end{array}$$

Aerial spraying programs which resulted in 97 percent control effectively reduced the budworm threat on some 161,000 acres near Eugene and 106,000 acres on the east side of the Mt. Hood National Forest.

The largest and most aggressive infestations are located in the Blue Mountains region. These infestations cover some 2,103,620 acres in the following intensities: light, 414,360; medium, 830,470; heavy, 561,640; very heavy, 287,860, and dead, 9,020 acres. The infested acreages on the various forests are as follows: Malheur, 127,900; Ochoco, 13,760; Umatilla, 1,148,010; Umatilla Indian Reservation, 7,780; Wallowa, 465,480; and Whitman, 325,669 acres.

2,103,350
a difference of
270 Ac ?

2,088,599
a difference of
15,021

Three small centers covering some 37,040 acres were found along the east slope of the Oregon Cascades. Two of the spots, both light infestation, showed up adjacent to the area sprayed last spring. One of these on the Mt. Hood National Forest covers some 7,470 acres, while the other spot on the Warm Springs Indian Reservation occupies some 25,520 acres. The third center, which is of moderate intensity, is on the Deschutes Forest.

In western Oregon new outbreaks were mapped on some 88,640 acres. The intensities of the infestations are as follows: light, 27,280 acres; moderate, 45,200 acres; heavy, 9,600 acres; very heavy, 6,560 acres. Some 78,400 acres of this infestation are within or adjacent to the Willamette National Forest. The remaining 10,240 acres are on private lands immediately north of Roseburg. - forest?

In the State of Washington there were no budworm defoliations of sufficient intensity to be detected from the air except in the

Blue Mountains region in the southeast corner of the State.

A more complete resume of the budworm situation will be found in the report entitled "Spruce Budworm Situation in Oregon and Washington, 1949 Season".

Larch Budworm (*Zeiraphera griseana*).

The extensive outbreaks discovered this season are the first recorded appearance of this insect in Washington or Oregon. Little is known of its habits or potential destructiveness. Larch stands were heavily defoliated and intermingled species of fir were fed on to some extent. It was observed that many of the heavily defoliated larch put forth adventitious buds and needles shortly after feeding ceased. Undoubtedly a number of seasons will have to elapse before the damage becomes apparent.

The only record of this insect in Oregon was from Eight Mile Creek on the Mt. Hood Forest where a few larch were partially defoliated.

In eastern Washington 54 centers were found covering 86,000 acres. The locations of these centers are as follows:

Wenatchee Forest, two centers, 61,000 acres. One of these centers, which is the largest in the region, covers some 59,000 acres on the east end of Wenatchee Mountain around Mission Peak and Colockum Pass. The other center of 2,000 acres is on Chumstick Mountain.

Chelan Forest, 3 centers, 1,000 acres, located west of Palmer Lake near the Canadian border.

Colville Forest, 45 spots, 13,000 acres. These spots were widely scattered over the forest. Undoubtedly most of the larch stands on the forest are infested to some degree.

Colville Indian Reservation, 4 centers, 11,000 acres; north and east sides of Grizzly Peak, 6,000 acres, east side of Sitdown Mountain, 400 acres, north side of Oregon City Ridge, 1,900 acres, and Beaver Dam Creek, 2,700 acres.

Lodgepole needle miner (*Recurvaria moreonella*) Hein.

Two outbreaks of this insect covering some 8,700 acres were found near the north boundary of the Fremont Forest in Oregon. The largest center just east of Sellers Marsh occupies some 6,700 acres. The smaller area on the west side of Skookum Butte covers approximately 2,000 acres. In the past outbreaks of this insect, which covered large areas near La Pine during the years 1925 to 1928 and around Crescent and Odell Lakes during 1945 to 1947, subsided without causing material damage to the stands.

Hemlock Looper (~~Ellopia~~ Lambidina *fiscellaria* var. *lugubrosa*).

During 1947 and 1948 this defoliator attacked hemlock in 116 different spots totaling some 3,700 acres along the coast in Pacific and Callam Counties of Washington.

In Callam County there were 16 spots of infestation covering some some 1600 acres. Fifteen of these were scattered over an area 4 by 5 miles in extent in the Hoko and Little Hoko River drainages. The largest center covered approximately 300 acres. Another center covering 60 acres was found some six miles west on the Sekui River. Defoliation was heavy in most spots and it appeared that a high percentage of the stand had succumbed.

In Pacific County 100 spots totaling approximately 2100 acres were mapped on an area approximately 4 by 8 miles largely within the drainages of the Palix River and Williams Creek, also the head of Minnie Creek. Defoliation was less severe than in Callam County and losses usually consisted of a few trees in the center of each spot.

It is believed that both infestations have subsided as no evidence of feeding during 1949 could be seen from the air and a ground examination of spots on the Hoko River failed to reveal any eggs.

Pine Sawfly (*Neodiprion* Sp.).

Ponderosa pine on some 800 or more acres near Tupper Guard Station on the Umatilla Forest, Oregon, was heavily defoliated during the past season. While the defoliation appears alarming, it is not believed serious. Recent experience with two large outbreaks on the Ochoco and Malheur Forests was that after two years'duration they subsided without causing material damage to the stand.

Should the spruce budworm control program be carried out in 1950, this area undoubtedly would be sprayed as fir is present in the stand. The sawfly brood would be in the half-grown larval stage at the time of spraying. Experiments indicate they are very susceptible to DDT.

Mountain Mahogany Defoliator (*Ethmia discostrigella*).

This shrub is important as browse for deer, especially in areas where they winter. Three more or less distinct areas covering some 10,000 acres in the Silvies River drainage on the Malheur Forest were heavily defoliated in 1947 and 1948. This outbreak ended very abruptly. There ~~were~~ no signs of feeding or insects when ground-checked last fall. From the air it was apparent that mahogany over large areas had been killed by the severe defoliation.

BARK BEETLES

Mountain Pine Beetle (*Dendroctonus monticolae*).

After being at a low level for many years the mountain pine beetle infestation is again showing an upward trend and in some localities is becoming aggressive.

In Washington ~~75~~ 95 centers covering some 42.180 23,600 acres were found along the Cascade Range from Mt. St. Helens north to Glacier Peak. On the east side of the range the infestation was largely confined to lodgepole pine, while on the west side of the crest the majority of the infestations occur in white pine.

52
2
54

In Oregon the centers of infestation were less numerous but larger. Twenty-one centers cover some 52,000 acres. The majority of these centers was found along the Cascade Range. In the Blue Mountains region infestations occur in both lodgepole and ponderosa pine, while along the Cascades attacks were generally limited to lodgepole.

Mt Baker Forest

20 centers 18.580 Acres

Swift Cr.		4000
Hidden		480
Noisy		800
Anderson		2080
Bacon		2400
Alma		480
Irene	10560	320
		10480 A

Illabot	600
"	320
Suiattle Mtn	160
"	80
"	80
"	40
Tenas cr	640
Huckleberry Mtn	3040
Buck Creek	2400
	7360 A

Downey Cr.	1600
Black cr.	100
Straight Cr	800
Circle PK	160
	2660 A

Washington Forests:

Wenatchee Forest. There are some 26 small and 4 large centers totaling some 14,800 acres. Locations of the small centers, which average less than 360 acres are as follows: three in the Entiat River drainage of which two are on Pope Creek and one on Brennegan Creek, eight along the Chiwawa River from Schaefer Creek to Little Giant Creek, two on White River near Canyon Creek, four along the Wenatchee River from Devil's Club Creek to Twelve-Mile Creek, six south of the lower end of Wenatchee Lake, one south of the east end of Fish Lake, one at the lower end of Chiwaukum Lake, and one on Power Creek near the crest of Icicle Ridge. The larger centers are in the following locations: two centers of approximately 1,000 acres each are near Mission Peak, one around Naneum Meadows, the other on Swift Creek; the third center, also of approximately 1,000 acres, is on the headwaters of the North Fork of Taneum Creek; the largest and most aggressive center in the state extends over some 11,000 acres at the confluence of the Chiwawa River and Big Meadow Creek.

Snoqualmie Forest. There are 26 centers of infestation covering approximately 4,300 acres. Distribution of these centers is as follows:

West slope of the Cascades: North Fork of Skykomish River between Bear and San Juan Creeks, 320 acres; Paradise Meadow north of Grotto Mountain, 160 acres; Huckleberry Mountain east of Greenwater, 9 spots covering 220 acres; Dalles Ridge just north of Noble Nob, 30 acres; Huckleberry Creek, 50 acres; West Fork of White River near

Viola Creek, two spots of 50 and 70 acres; Pinochle Creek, 50 acres; head of Clearwater River, 90 acres; Puyallup River near Swift Creek, 15 acres; Copper Creek above Ashford, 10 acres; Storm King Mountain south of Mineral, 800 acres.

East slope of Cascades: All infestations are in the Naches River drainage. On ridge between Swamp Creek and Lost Creek, 1,280 acres; between Forks of Quartz Creek, 960 acres; upper portion of Pileup Creek, 160 acres; Bear Creek, 80 acres; Middle Fork of Naches River, 10 acres; and 10 acres on an unnamed creek just north of the Middle Fork.

Pinchot Forest (Columbia). Twelve centers covering some 3300 acres were mapped in the following locations:

Cowlitz Drainage: south of Willame Lake, 40 acres; south end of Davis Mountain, 80 acres; Smith Creek near South Point, 20 acres.

Cispus Drainage: Above Cispus Road from Mile Post No. 15 to Mile Post No. 20, 500 acres; between road and Cispus River west of Elk Creek, 100 acres; west of Sheep Creek, 340 acres; east of Squaw Creek - Cispus River junction, 30 acres; and north of Hat Rock, 100 acres.

Lewis River Drainage: Head of Alec Creek, 60 acres; north of Surprise Meadow, 300 acres; east side of McCellan Meadow, 400 acres.

The largest and most aggressive infestation on the forest covers some 1,330 acres near timber line on the east side of Mt. St. Helens.

Olympic National Park. The infestation was widely scattered and generally limited to small groups or single trees at the higher elevations.

Olympic Forest
The few centers noted were small and widely scattered. They were not mapped.

Rainier National Park. Seven centers covering some 1200 acres are present in the following locations: Cowlitz Divide and Backbone Ridge, 480 acres; Ramparts Ridge above Longmire, 380 acres; north side of Tum Tum Peak, 160 acres; head of Tenas Creek above the Nisqually entrance, 90 acres; between Mowich River and Paul Peak, 80 acres; one 5-acre spot on the south side and a similar spot on the north side of Sweet Peak in the northwest corner of the park.

Oregon Forests:

Mt. Hood Forest. Six centers covering some 5,950 acres were mapped in the following locations:

Zig Zag and Salmon River drainages: Hunchback Mountain, 1800 acres; on ridge between Still and Wind Creeks, 1200 acres, Plaza Guard Station, 960 acres; and on ridge west of Mark Hall Creek, 640 acres.

Some 1400 acres of heavy infestation is on the east slope of Sisi Butte and four small spots which probably cover 50 acres were noted around Averill Lake and Wall Lake.

Deschutes Forest. Three centers of infestation were found to extend over some 30,120 acres in the following locations: Wanoga Butte north to Swampy Lakes, 30,000 acres - this is the largest and most aggressive center in the state; Snow Creek, 40 acres - this stand is in a low spot adjacent to the Crane Prairie Reservoir and undoubtedly is affected by flooding; a light infestation covers some 80 acres on the northwest side of Hammer Butte.

Rogue River Forest. Four centers covering some 1,760 acres were found on the southeast corner of the forest. Two-hundred acres were south of the east end of Buck Lake; 600 acres near Muddy Spring on the Buck Lake - Ashland Road; 940 acres east of Lake of the Woods on the Mountain Lakes trail; and 20 acres south of Seven Mile Guard Station.

Fremont Forest. Only one center was found on the forest. This covers some 980 acres on Dismal Creek and extends a short distance into California.

Crater Lake Park. A few scattered trees were noted on the south boundary of the park between the highway and Wildcat Creek.

Klamath Indian Reservation. Two centers of moderate infestation covering some 2600 acres were found in the following locations: west bank of Williamson River one mile north of Chiloquin, 600 acres; Long and Coyote Creeks adjacent to Sycan Marsh, 2,000 acres.

Blue Mountains Region (Oregon and Washington):

Five centers of infestation covering 10,450 acres were found in this region. Two were in lodgepole pine stands and three were in predominantly ponderosa pine second growth.

Malheur Forest. Only one center was found on the forest. This infestation covers some 50 acres of lodgepole at the junction of West Fork and the Middle Forks of Wolf Creek.

Whitman Forest. Three centers covering some 6700 acres were mapped in a mixed stand of ponderosa pine and Douglas fir along the west side of the Powder River Valley. One center of 1900 acres is on Rock Creek and extends south to Hunt Mountain. The largest center of 2600 acres is on Bulgar Flat. The third center of some 2200 acres is on Shingle Creek. These areas were cut over many years ago and now support a heavy stand of advanced second growth. Some trees have attained a diameter of 24 D.B.H. or more. The stand has become badly stagnated, rendering it more susceptible to insect attack. Groups up to 15 or more trees are being killed. Losses will average 500 or more per section. The infestation decreased considerably during the past season, largely due to mortality caused by sub-zero temperatures to overwintering broods of the mountain pine beetle.

Wallowa Forest. Only one center of infestation exists on the forest. It extends over some 3800 acres of lodgepole pine which is mostly in the bottoms of Pea Vine and the West Fork of Broady Creeks. This infestation, which has been in progress since 1946, is declining largely due to exhaustion of host material.

Western Pine Beetle (Dendroctonus brevicomis).

The infestation was uniformly light throughout the ponderosa pine stands of the region. The only exceptions were three centers of moderate infestation covering some 11,300 acres in the following locations:

Rogue River Forest: One center covering some 7500 acres on the South Fork of the Rogue River above Imnaha Creek.

Fremont Forest: Two centers, 3800 acres. Two thousand acres under south end of Summer Lake Rim, 1800 acres on North Fork of Sprague River south of the lower end of Box Canyon.

Oregon Pine Engraver (Ips oregoni).

The severe drought conditions of the past season provided conditions favorable for the increase of this insect. As a result numerous small spots of infestation appeared on many of the logging operations in ponderosa pine in both Oregon and Washington.

Douglas Fir Beetle.

In Western Washington the activity of the Douglas fir bark beetle is at a low ebb. Only on three centers covering some 2900 acres was the infestation of sufficient intensity to warrant mapping. These centers were usually associated with some type of stand disturbance such as logging fire or snow break. [In Eastern Washington the epidemic is declining from a high point reached during 1946-47. 35 centers covering some 58200 acres were mapped]

Please disregard these figures PED

In Oregon the infestation was at a somewhat higher level. Eighteen centers covering approximately 197,100 acres were found. Sixteen of these centers covering some 13,000 acres were located in western Oregon. In this part of the region the infestation usually occurred as small groups or single trees in stands on the poorer sites. The other two centers, which cover some 184,100 acres, are located in the Blue Mountains region. The infestation on these centers is slowly subsiding from an epidemic which reached a peak on the Wallowa Forest in 1947 and on the Umatilla Forest in 1948. The flare-up on the latter area followed in the wake of heavy defoliation by the Tussock moth during 1946 and 1947 in stands near Troy, Oregon.

As yet there is no indication that the Douglas fir beetle has initiated large-scale attacks on trees weakened by spruce budworm defoliations.

Oregon Areas:

Siuslaw Forest. Five areas, 1,840 acres. Mary's Peak, 880 acres; vicinity of Roman Nose Mountain, 320 acres; Mill Creek near Alsea Guard Station, 320 acres; and on Buck Creek two patches of 160 acres each.

Willamette Forest. Six areas, 4,640 acres. Monument Peak, 320 acres; Carpenter Mountain, 800 acres; McFarland Peak, 960 acres; Mossy Glen Camp, 640 acres; McGowan Mountain, 1120 acres; and Captain Jack Peak, 800 acres.

Umpqua Forest. Two areas, 3360 acres. In vicinity of Grass Mountain, 960 acres; and Big Bend Creek, 2400 acres.

Rogue River Forest. Three areas, 3200 acres. Elkhorn Prairie Region, 1120 acres; Whiskey Peak, 1760 acres; and Red Mound, 320 acres.

Wallowa Forest. One area, 180,000 acres. This area occupies most of the northeast portion of the forest.

Umatilla Forest. One area, 4100 acres. Between the Wenaha and Grande Ronde Rivers above Troy, Oregon.

Washington Areas:

Mt. Baker Forest. Two areas, 2500 acres. Tenas Creek, 900 acres; Suiattle River above Tenas Creek, 1600 acres.

Colville NF = Toroda-SanPoil
Aeneas valley
37 centers 49.000 A

Colville Ind. Res.
Lost Cr Nespelem + SanPoil R.
18 centers 31.200 A

Chelan NF Eightmile Cr
Pete Cr
Ramsey Cr
3 centers 2000 A

Pinchot Forest. One center, 400 acres, east of Gilmer.

Fir Engraver Beetles (*Pseudohylesinus* sp.).

In recent years foresters and entomologists have become increasingly aware of the tremendous losses occurring in stands of white and silver fir along the west slope of the Cascade Range and the Olympic Mountains in Washington. As yet the agencies responsible for the death of the trees have not been definitely determined. However, a bark beetle, Pseudohylesinus, seems to play a prominent role. Studies have been inaugurated in an attempt to solve this problem.

A total of 10~~9~~8 centers extending over ~~126,600~~ 54 600 acres were mapped. Of this total ~~95~~ 94 centers covering some ~~122,600~~ 50.600 acres are along the west slope of the Cascades and 14 centers covering approximately 4,000 acres around the Olympic Mountains.

The distribution of the centers ise as follows:

Mt. Baker Forest.

Location	Number of Centers	Acres
Nooksack River	4	1,450
Middle Fork of Nooksack River	3	120
South Fork " " "	15	5,080
Baker River	9	8,080
Skagit River above Rockport	6	3,090
Suiattle River	12	11,340
Sauk River	1	320
South Fork of Stillaguamish River	2	1,920
The mountain range between the Skagit and Stillaguamish Rivers	16	16,880
Total	68	48,280

Snoqualmie Forest.

Elwell Creek	1	1,600
North Creek - Tolt River	1	320
So. Fork of Tolt River	1	460
Calligan Lake	1	640
Green River above Kanasket	~~5~~	~~72,000~~
West Fork of Little Nisqually River	~~2~~	960
Deschutes River	1	800
Total	~~12~~ 6	~~76~~ 4,780

Pinchot (Columbia) Forest.

Location	Number of Centers	Acres
Cispus River	2	140
Toutle River	2	80
South Fork of Toutle River	4	340
Canyon Creek	2	700
Wind River	5	280
Total	15	1,540

Olympic Forest.

Lake Crescent	3	700
Soleduck River	4	1,360
Calawah "	3	820
Clearwater "	1	160
Queets "	1	600
Hamma "	1	160
Duckabush "	1	200
Total	14	4,000

The Fir Engraver (*Scolytus ventralis*).

This insect, which frequently causes extensive damage to white and Alpine fir stands, has been at a low infestation level for some time. This season, however, 8 acres of light to moderate epidemic covering some 7500 acres were discovered along the Oregon Cascades in the following locations:

Willamette Forest: Two areas, 600 acres. The Three Pyramids, 200 acres; and Hogg Butte, 400 acres.

Umpqua Forest: One area of 1200 acres on Snowbird Mountain.

Deschutes Forest: Two areas, 5700 acres. Cash Mountain, 600 acres; Meadow Lake and Circle Lake, 1600 acres; and Square Lake, 3500 acres.

The Fir Engraver (Scolytus unispinosus).

This insect is usually found attacking weakened, injured, or dying Douglas fir,also slash. However, from 1947 through 1949 it flared up and caused extensive damage to stands in the Tualatin River Valley, Oregon. The stands in the valley bottom are of the wood lot type ranging from one to forty acres or more in size and gradually merge with the forest areas at the edges of the valley. In many places ten percent or more of the stand has been affected. It is estimated there are 200 spots of infestation extending over some 4500 acres.

OTHER AGENCIES

Fungus.

Damage to fir, pine and larch stands from needle cast fungus was noted in many places. In some instances considerable difficulty was experienced by the observers to distinguish fungus attack on fir stands from a light defoliation by the budworm. Nearly all cases of uncertainty were ground-checked.

The region around Mt. Hood was most heavily affected. In this area there were 11 centers ranging from 40 to 600 acres in the following locations: Lookout Mountain, East Fork of Hood River, Starvation Creek, Green Point, Long Branch Creek, Ladd Creek, Elk Creek, Bald Mountain, and Eagle Butte. Considerable white pine blister rust was also prevalent in this region.

Four centers were present on the Willamette Forest in the following locations: Groundhog Mountain, Wolf Mountain, Pinto Mountain, and Summit Lake.

A center covering 1200 acres was found on Rickreall Creek near Dallas, Oregon.

Three centers were found on the Deschutes Forest in the following locations: Cache Mountain, Link Creek, and Square Lake.

In Washington a high percentage of the larch stands were affected to some extent. Usually the infections were quite light.

In the ponderosa pine stands of Oregon some improvement was noted in many of the areas which have been heavily infected for a number of years.

TABLE NO. 1

SUMMARY OF AERIAL SURVEY OPERATIONS - 1949

Area	Timbered Acres Covered	Air Miles Flown	Mapping Hours	Ferry Hours	Total Hours
Western Oregon	15,670,000	7.580	61.5	3.9	65.4
Eastern Oregon Cascades	6,591,000	2.720	21.8	6.8	28.6
Blue Mountains	6,964,000	3.460	27.8	8.6	36.4
Eastern Washington	8,001,000	3.180	24.9	4.9	36.6
Western Washington	11,774,000	5.330	36.4	7.1	43.5
TOTALS	49,000,000	22.270	172.4	31.3	210.5

TABLE NO. 2

SUMMARY OF INFESTATION CENTERS MAPPED ON 1949 AERIAL SURVEY

	Washington		Oregon		Total	
Insect	No. of Centers	Acres	No. of Centers	Acres	No. of Centers	Acres
DEFOLIATORS						
Spruce budworm	* 3	170,320	39	2,096,960	42	2,267,280
Larch budworm Zieraphera griseana	54	86,000	1	-	55	86,000
Lodgepole needle miner, Recurvaria moreonella			2	8,700	2	8,700
Pine sawfly Neodiprion Sp.			1	800	1	800
Mountain mahogany defoliator, Ethmia discostrigella			3	10,000	3	10,000
Sub Total	57	256,320	46	2,116,460	103	7 2,372,~~9~~80
BARK BEETLES						
Mountain pine beetle	95 ~~75~~	42 180 ~~23,600~~	21	52,000	116 ~~96~~	94 180 ~~75,600~~
Western pine beetle			3	11,300	3	11,300
Fir engraver beetle Pseudohylesinus	109	126,600			109	126,600
White fir engraver Scolytus ventralis			6	7,500	6	7,500
Douglas fir engraver, Scolytus unispinosus			200	4,500	200	4,500
Douglas fir bark beetle	58 ~~3~~	80200 ~~2,900~~	18	197,100	76 ~~21~~	277,300 ~~200,000~~
Sub Total	262 ~~187~~	176980 ~~153,100~~	248	272,400	509 ~~435~~	449380 ~~425,500~~
GRAND TOTAL	318 ~~244~~	433300 ~~409,420~~	294	2,388,860	612 ~~538~~	2,822,160 ~~2,798,480~~

*Blue Mountains Region